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CHARACTERISTICS OF THE PLASMA DISTURBANCE EXCITED AT ALTITUDES OF 450–500 km DURING THE "SURA" FACILITY OPERATION

V. L. Frolov,[1,3*] R. Yu. Lukyanova,[2] A. S. Belov,[1,4] I. A Bolotin,[1] M. N. Dobrovolsky,[2] A. O. Ryabov,[1] and E. A. Shorokhova[4]

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We discuss the results of measuring characteristics of the artificial plasma disturbances excited at altitudes of 450–500 *km with the ionospheric F_2 layer modified by high-power HF radio waves from the Sura facility. It is found that at these altitudes there are plasma temperature and density variations in the HF-perturbed magnetic flux tube. No ducts with increased plasma density that were previously observed at altitudes of about 660 km were detected. The results of the studies are compared with the data from the DEMETER satellite and the results of radiotomographic measurements. It is noted that the field-aligned currents induced in a perturbed ionosphere during the Sura operation were detected for the first time using SWARM satellites.*

1. INTRODUCTION

The experiments performed at the Sura mid-latitude heating facility (Radiophysical Research Institute of the N. I. Lobachevsky State University of Nizhny Novgorod) on modification of the ionospheric F_2 layers by high-power HF radio waves with ordinary (O) polarization have convincingly shown that if the pump wave frequency (f_0) is slightly below the cutoff frequency f_{0F_2} of the ionospheric F_2 region, then intense artificial ionospheric turbulence develops in the ionospheric plasma [1-5]. In the evening and night-time conditions, the generation of artificial plasma disturbances (first of all, the plasma density and temperature perturbations) is detected over the entire depth of the ionosphere from the E region to altitudes of the order of 1000 km or more. The disturbances themselves at the level of the ionospheric F_2 region in the horizontal direction are recorded at distances of up to 200–500 km, far beyond the area exposed to a beam of high-power radio waves [2, 4, 5]. We note the results of the experiments performed at the Tromsø facility (Norway), in which a strong increase in electron temperature during sounding of the perturbed ionospheric region by an incoherent scatter radar in the F_2 region at altitudes of up to $h \approx 600$ km (i. e, at least up to the maximum altitudes at which disturbances are detectable by the radar being used) and forcing of ions upwards along the geomagnetic field lines out of the heated ionospheric region were recorded [6].

Strong heating of the plasma under conditions of the evening and night-time ionosphere leads to the formation of a region with reduced plasma density near the level of the pump wave (PW) reflection. This region is filled with artificial ionospheric irregularities whose sizes $l_\perp$ orthogonal to the geomagnetic field range from fractions of a meter to tens of kilometers and which are excited as a result of the development

* frolov@nirfi.unn.ru

[1] Radiophysical Research Institute of N. I. Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod; [2] Geophysical Center of the Russian Academy of Sciences, Moscow; [3] Kazan (Volga) Federal University, Kazan; [4] Yu. E. Sedakov Research Institute of Measuring Systems, Branch of Russian Federation Nuclear Center — All-Russia Research Institute of Experimental Physics, Nizhny Novgorod, Russia. Translated from Izvestiya Vysshikh Uchebnykh Zavedenii, Radiofizika, Vol. 61, No. 5, pp. 359–373, May 2018. Original article submitted April 3, 2018; accepted May 29, 2018.

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